Amendments to the Specification:

Please replace the Title section with the following amended Title section:

~~DESCRIPTION~~

~~Magnetic detection device, magnetic detector and method for producing the same~~

TITLE OF THE INVENTION

Magnetic Detection Device, Magnetic Detector and Method for Producing the Same

CROSS-REFERENCE TO RELATED APPLICATION

This application is a Section 371 of International Application No. PCT/JP03/03546, filed March 24, 2003, the disclosure of which is incorporated herein by reference.

Please replace the paragraph at page 8, line 10 to line 16 with the following amended paragraph:

In the magnetic sensor in accordance with the second conventional example shown in Fig. 32, the [[~~coil 7~~]] coil 10 for generating the DC bias magnetic field is large and its power consumption is large, although its detection sensitivity is high. For this reason, a magnetic sensor being compact in size and low in power consumption cannot be attained.

Please replace the paragraph at page 20, line 22 with the following amended paragraph:

Part (b) of FIG. 1 is a [[~~b-b~~]] Ib-Ib cross-sectional view of part (a);

Please replace the paragraph at page 26, line 10 to page 27, line 26 with the following amended paragraph:

Part (a) of FIG. 1 is a plan view of a magnetic detection device in accordance with a first embodiment of the present invention, and part (b) thereof is a [[~~b-b~~]] Ib-Ib cross-sectional view of part (a). In the magnetic detection device shown in FIG. 1, a first magnetic core 11 made of a soft magnetic film is formed in a band shape on a substrate 41 made of a nonmagnetic material, such

as ceramic. A conductive wire 14 made of a thin film is formed on the magnetic core 11 at the central portion thereof, and a second magnetic core 12 made of a soft magnetic film is formed on the magnetic core 11 and the conductive wire 14. In other words, the conductive wire 14 is held between the magnetic core 11 and the magnetic core 12, and both end portions 134 and 137 of the conductive wire 14 are extended outward. The magnetic core 12 has step portions 12a generated by the conductive wire 14. The step portions 12a of the magnetic core 12 are made thinner than the other portion, that is, the thickness L thereof is about half the thickness of the other portion. Hence, the area of the cross-section perpendicular to a magnetic path at the step portions 12a of the magnetic core becomes smaller than that of the other portion. In order to decrease the thickness L of the step portion 12a, it is desirable that the angle θ of the fringe portion 14c of the conductive wire 14 with respect to the face of the magnetic core 11 should be made close to 90 degrees as shown in part (b) of FIG. 1. Processing for making the angle θ close to 90 degrees can be done by properly selecting the material and thickness of a resist film, etching conditions, etc. when a conductive film is formed on the magnetic core 11 and etched while a portion to become the conductive wire 14 is left by using photoresist. Furthermore, the well-known liftoff method may also be used. In order that the thickness L of the step portion 12a is decreased, the thickness of the magnetic film formed at the fringe portion 14c of the conductive wire 14 can be made smaller by adjusting the film formation conditions of a magnetic film when the magnetic core 12 is formed.

Please replace the paragraph at page 36, line 23 to page 37, line 13 with the following amended paragraph:

When a magnetic detector in this state is placed in the external magnetic field 100 as shown in part (c) of FIG. 3, the magnetic flux 36 generated by the external magnetic field 100 passes through the magnetic core 11, and a magnetic flux 33a passes through the magnetic core 12. By the magnetic fluxes 36 and 33a, the magnetic field intensities H11, H12 and H22 change as respectively indicated by arrows as shown in FIG. 29. In other words, the magnetic field intensity H11 decreases to [[~~H11a~~]] <u>H11b</u>, and both the magnetic field intensities H12 and H22

increase to magnetic field intensities H12a and H22a, respectively. All the permeabilities E11, E12 and E22 decrease to permeabilities E11a, E12a and E22a, respectively. As a result, the impedance across both terminals 134 and 137 of the conductive wire 14 lowers, and the level of the carrier signal lowers.

Please replace the paragraph at page 37, line 14 to page 38, line 14 with the following amended paragraph:

In the case when the direction of the external magnetic field is directed from right to left in part (c) of FIG. 3, that is, the direction indicated by arrow 200, the magnetic field intensity H11 increases to [[~~H11b~~]] <u>H11a</u> in FIG. 29. Both the magnetic field intensities H12 and H22 decrease to magnetic field intensities H12b and H22b, respectively. The changes of the magnetic field intensities H11 and H12 only slightly contribute to the changes of permeabilities; however, as the result of the change of the magnetic field intensity H22 to H22b, the permeability E22 increases greatly to permeability E22b. When the direction of the external magnetic field changes in this way, the permeability of the magnetic paths 34 and 35, the cross-sectional areas of which are made smaller by the grooves 22 as shown in part (c) of FIG. 3, changes greatly, whereby the direction of the external magnetic field 100 can be detected. The level of the carrier signal across both terminals 134 and 137 of the conductive wire 14 changes depending on the change of the impedance of the conductive wire 14, which is proportional to the change of the permeability. By amplifying and detecting the high-frequency voltage of this carrier signal using the high-frequency amplifier 139, the direction and intensity of the external magnetic field 100 can be detected as an electrical signal.

Please replace the paragraph at page 40, line 19 to page 41, line 3 with the following amended paragraph:

Parts (a) and (b) of FIG. 8 are a plan view and a [[~~b-b~~]] <u>VIIIb – VIIIb</u> (Sic) cross-sectional view, respectively, of still another example of the magnetic detection device. In this example, a circular or elliptic hole 61 is formed in a

magnetic core 12j disposed on the upper side at a portion contacting the conductive wire 14. Since the hole 61 is formed, the cross-sectional area of the magnetic core 12j is made smaller at this portion. By changing the area of the hole 61, this portion of the magnetic core 12j can have a desired cross-sectional area.

Please replace the paragraph at page 41, lines 4 to 14 with the following amended paragraph:

Parts (a) and (b) of FIG. 9 are a plan view and a [[~~b-b~~]] IXb – IXb cross-sectional view, respectively, of still another example of the magnetic detection device. In this example, a circular or elliptic depressed portion 62 is formed in the upper face of a magnetic core 12j disposed on the upper side. By changing the area and depth of the depressed portion 62, this portion of the magnetic core can have a desired cross-sectional area. The shape of the hole 61 or the depressed portion 62 is not limited to be circular or elliptic, but other shapes may be used.

Please replace the paragraph at page 44, line 12 to page 45, line 4 with the following amended paragraph:

In the example shown in part (b) of FIG. 11, after the magnetic core 44 having a thickness of 3 μm is formed on the substrate 41, the surface portion of the central region 46a of the magnetic core 44 is removed so that the thickness is made thin to about 1.5 μm. On the magnetic core 44 in the end region T, the magnetic core 45 having a thickness of 1.5 μm is formed at a portion away from the magnetic core 12. The other configuration is the same as that shown in part (a) of FIG. 11. In this example, the film thickness of the magnetic flux inflow portion 40 at the end portion of the substrate 41 is 4.5μm, and the film thickness of the magnetic core 44 at the central region 46a in the vicinity of the conductive wire 14 [[~~43~~]] is 1.5 μm, whereby the thicknesses ratio is three. As a result, the magnetic flux density in the central region 46a of the magnetic core 44 is about three times as high as that in the end region T, and sensitivity is raised further.

Please replace the paragraph at page 75, line 26 to page 77, line 1 with the following amended paragraph:

The DC current flowing from the DC power source 185 to the conductive wire 140 via the resistor 180 generates a magnetic flux indicated by arrow 170 in FIG. 27 (hereafter referred to as a bias magnetic flux 170) in the magnetic cores 151 and 158 of each detection unit 150. This bias magnetic flux 170 forms a bias magnetic field. When the magnetic detector being in this state is placed in an external magnetic field 100 shown in FIG. 28, the inductance of the conductive wire 155 changes depending on the change of the external magnetic field 100 owing to an action similar to that in the case of each of the above-mentioned embodiments. Depending on the change of the impedance of the conductive wire 155, the oscillation frequency of the oscillation circuit 500 in the detection circuit shown in FIG. 28 changes, and a frequency modulated (FM) signal is output. By demodulating the frequency modulated signal of the oscillation circuit 500 using an FM demodulation circuit 561, the change amount of the oscillation frequency can be output as the change amount of the output level. Since the change of the oscillation frequency corresponds to the changes of the intensity and direction of the external magnetic field, the intensity and direction of the external magnetic field can be detected by detecting the output of the FM demodulation circuit 561 using a magnetic field detection circuit 562.